existence of systems intended to facilitate the care process, such as those incorporating electronic medical records ("EMR") and computerized provider order entry ("CPOE"), the process of providing comprehensive care to patients including ordering and delivering medical treatments, such as medications, is associated with a number of non-trivial issues.

[0026] Peristaltic pumps are used in a variety of applications such as medical applications, especially fluid transfer applications that would benefit from isolation of fluid from the system and other fluids. Some peristaltic pumps work by compressing or squeezing a length of flexible tubing. A mechanical mechanism pinches a portion of the tubing and pushes any fluid trapped in the tubing in the direction of rotation. There are rotary peristaltic pumps and finger peristaltic pumps.

[0027] Rotary peristaltic pumps typically move liquids through flexible tubing placed in an arc-shaped raceway. Rotary peristaltic pumps are generally made of two to four rollers placed on a roller carrier driven rotationally by a motor. A typical rotary peristaltic pump has a rotor assembly with pinch rollers that apply pressure to the flexible tubing at spaced locations to provide a squeezing action on the tubing against an occlusion bed. The occlusion of the tubing creates increased pressure ahead of the squeezed area and reduced pressure behind that area, thereby forcing a liquid through the tubing as the rotor assembly moves the pinch rollers along the tubing. In order to operate, there must always be an occlusion zone; in other words, at least one of the rollers is always pressing on the tube.

[0028] Finger peristaltic pumps are made of a series of fingers moving in cyclical fashion to flatten a flexible tube against a counter surface. The fingers move essentially vertically, in wave-like fashion, forming a zone of occlusion that moves from upstream to downstream. The last finger—the furthest downstream—raises up when the first finger—the furthest upstream—presses against the counter surface. The most commonly used finger pumps are linear, meaning that the counter surface is flat and the fingers are parallel. In this case, the fingers are controlled by a series of cams arranged one behind another, each cam cooperating with a finger. These cams are placed helically offset on a shared shaft driven rotationally by a motor. There are also rotary-finger peristaltic pumps, which attempt to combine the advantages of roller pumps with those of finger pumps. In this type of pump, the counter surface is not flat, but arc-shaped, and the fingers are arranged radially inside the counter surface. In this case, a shared cam with multiple knobs placed in the center of the arc is used to activate the fingers.

SUMMARY

[0029] A peristaltic pump, and related system method are provided. The peristaltic pump includes a cam shaft, first and second pinch-valve cams, first and second pinch-valve cam followers, a plunger cam, a plunger-cam follower, a tube receiver, and a spring-biased plunger. The first and second pinch-valve cams are coupled to the cam shaft. The first and second pinch-valve cam followers each engage the first and second pinch-valve cams, respectively. The plunger cam is coupled to the cam shaft. The plunger-cam follower engages the plunger cam. The tube receiver is configured to receive a tube. The spring-biased plunger is coupled to the plunger-cam follower such that the expansion of the plunger cam along a radial angle intersecting the plunger-cam follower as the cam shaft rotates pushes the plunger cam follower towards the plunger and thereby disengages the spring-biased plunger from the tube. A spring coupled to the spring-biased plunger biases the spring-biased plunger to apply the crushing force to the tube.

[0030] In some embodiments, a slide occluder includes an RFID tag and the infusion pump includes an RFID interrogator. A processor associated with (or in) the infusion pump interrogates the RFID tag to determine if the slide occluder is authorized for use. For example, the RFID tag may have an encryption key and/or authorized identification value.

[0031] In some embodiments, a cam profile for an infusion pump may be shaped such that rotation in any direction causes forward flow.

[0032] In some embodiments, an infusion pump may include a downstream occluder to create a smooth fluid flow to the patient.

[0033] In some embodiments, the infusion pump may automatically prime, e.g., the tube may have an RFID tag and/or a barcode that may be read by the pump, which the pump uses to estimate a priming volume of the downstream tube automatically (for fluid flow estimation, etc.)

[0034] In some embodiments, an infusion pump includes a resistive element that is compressed against a tube. The infusion pump estimates the fluid pressure in accordance with the resistance.

[0035] In some embodiments, the infusion pump includes a temperature sensor to estimate the temperature of the fluid within the tube. The infusion pump may correct for the temperature of the tube and/or fluid in its fluid flow calculation (e.g., the delta fluid estimation described below).

[0036] In some embodiments, a display on a pump UI will display instructions how to install the slide occluder (e.g., when the ID in an RFID tag in an occluder is an unauthorized ID, for example).

[0037] In some embodiments, an electronics module is attachable to an infusion pump to control the pump. The electronics module may include an RF transceiver, a battery, and a control component.

[0038] In some embodiment of the present disclosure, a peristaltic pump includes a cam shaft, first and second pinch-valve cams, first and second pinch-valve cam followers, a plunger cam, a plunger-cam follower, a tube receiver, a spring-biased plunger, a position sensor, and a processor. The first and second pinch-valve cams are operatively coupled to the cam shaft. The first and second pinch-valve cam followers are configured to engage the first and second pinch-valve cams. The plunger cam is coupled to the cam shaft. The plunger-cam follower is configured to engage the plunger cam. The tube receiver is configured to receive a tube. The spring-biased plunger is coupled to the plunger-cam follower such that expansion of the plunger cam along a radial angle intersecting the plunger-cam follower as the cam shaft rotates pushes the plunger cam to disengage the spring-biased plunger from the tube. A spring is coupled to the spring-biased plunger to bias the spring-biased plunger to apply the crushing force to the tube. The position sensor is operatively coupled to the spring-biased plunger configured to determine a position of the spring-biased plunger. The processor is coupled to the position sensor and is configured to estimate fluid flow of fluid within the tube utilizing the position using the position sensor.